

REHABILITATION OF THE HUMAN VOICE *

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REHABILITATION of the human voice is a branch of general rehabilitation that is little known to the medical profession but is growing in scope and importance. In modern society voice is an indispensable tool for almost all occupations. Impairment of the voice is a severe handicap for the teacher, the minister, the lawyer, the physician, the businessman and, of course, for the actor and singer.

First, we must be clear about the meaning of the term voice. Human speech is voice plus articulation. The airstream expelled from the lungs is transformed into sound by the vibration of the vocal cords. This sound is then modified and reinforced by the resonating cavities of the throat and mouth and, to a much lesser degree, by the nasal cavities. Vowels are produced by changes in the position of the oral structures. The voice sound that emerges is transformed into speech by articulatory movements of lips, tongue, and soft palate. Speech without voice is tuneless whisper. Voice without articulation is sheer sound that may express moods and emotions, as every mother knows who interprets the speechless cry of her baby.

Even after full development of speech the voice continues to contribute to communication the countless varieties of emotional shadings. Psychologically speaking, voice carries the emotional message of speech while articulation expresses the factual contents.

The goal of vocal rehabilitation is the restoration of a usable and, where possible, normal voice in all conditions that impair or prevent vocal function.¹

*Presented at a meeting of the New York Society for Physical Medicine and Rehabilitation, at The New York Academy of Medicine, December 2, 1964. For a more detailed treatment of the subject the reader is referred to the author's book, *Vocal Rehabilitation*.¹ This paper reviews the subject within the limits of available space.

CLASSIFICATION OF VOICE DISORDERS

For practical purposes we distinguish between two large groups of voice disorders: functional and organic impairments of the voice. By functional voice disorders we understand conditions where abuse or misuse of the voice is the major cause of voice impairment. As a rule, hyperfunctional phonation, the excess of muscular effort and/or of breath pressure, is the typical form of voice production in these cases. It is only after prolonged hyperfunctional misuse of the voice that the vocal organs become weakened and the voice becomes hypofunctional to the point of paretic hoarseness (Jackson's myasthenia laryngis²).

In functional voice problems the laryngologist who examines the larynx may find the vocal cords quite normal. Sometimes the inner margin of the cords may be congested or thickened or the cords may not properly close on phonation. If the stress on the vocal cords persists, various forms of tissue changes may be produced, such as nodules or polyps of the vocal cords or contact ulcers. Baker³ has suggested using the term chronic nonspecific laryngitis for all forms of voice impairment—with or without tissue changes—that are caused by faulty voice production. I have followed a suggestion made to me by Dr. Martin Goldner, in using the term laryngosis as the internistic terms nephrosis and hepatitis are used.

In addition, we have two rarer forms of functional voice disorders of purely psychogenic origin: the so-called hysteric aphonia and the spastic dysphonia. These present two opposing vocal extremes of disturbed communication. The aphonic patient is unable to produce any vibratory sound and speaks in a tuneless whisper. But he is quite able to produce loud sounds of noncommunicative character such as a resonant cough. The patient with spastic dysphonia speaks with spastic contractions of the cords similar to the lip and tongue pressures of the stutterer.

In contrast to the functional voice problems we have a completely different situation: organic disorders of the voice. Here we deal with persons who are genuinely handicapped in the sense well known in rehabilitational work. Changes of structures, loss of tissues, impairment of neurological function are the primary events, and impairment of the voice is the result of the organic handicap. In other words, in contrast to the functional group, where abuse or misuse of the voice is the

etiology and tissue changes of the vocal cords the result of faulty production of the voice, the organic-voice patient suffers from voice impairment because some purely medical pathology has damaged structures or function of the vocal organs. In this group we have such conditions as paralysis of the vocal cords or of the soft palate, leukoplakias or postanesthetic granulomas of the cords, arthritic immobilization of the arytenoid cartilages, laryngeal traumas, neurological disorders and, most important, the vocally handicapped patient after operation for cancer of the tongue, the palate, or the larynx.

From a therapeutic point of view these two major groups of vocal disorders present different problems for the rehabilitation of the voice. In the functional group we must try to remove the underlying cause, abuse, or misuse of the voice. Our goal is to normalize the voice, to eliminate the excessive strain on the vocal organs that have produced nodules, a polyp, or a contact ulcer. In other words, we try to remove the cause of the voice disorder. In the organic cases we deal with a genuinely handicapped patient, and we must try to redevelop as much of a usable voice as possible in order to restore the patient to social and occupational function.

INCIDENCE OF VOICE DISORDERS

In a previous paper⁴ I have tried to analyze the incidence of all forms of voice disorders. The following figures are based on this earlier analysis brought up to date. Altogether 1,404 patients with voice disorders were seen. Of these patients 1,099 (or 78.27 per cent) were in the functional group while 305 (or 21.73 per cent) were organic cases. Table I shows the analysis of the functional group. A few facts stand out in this tabulation. As will be seen, the diagnosis of hyperfunctional disorders (without tissue changes) leads with 280 cases, followed by polyps (218 cases) and by nodules (215 cases). Nodules in children are more frequent in boys but after puberty the picture changes completely: 137 women are in this category and only 28 men. While nodules are more frequent in persons of younger age, polyps and contact ulcers occur mostly in middle age. This fact has interesting implications. Polypoid thickening of the vocal cords is twice as frequent in women as in men, and it occurs mostly at an age when menopause begins, which suggests that hormonal changes may play a role in the development of this lesion. Generally speaking we may say that aside

TABLE I—FUNCTIONAL VOICE DISORDERS

<i>Diagnosis</i>	<i>No. cases</i>	<i>%</i>	<i>Sex</i>		<i>Mean age</i>
			<i>M.</i>	<i>F.</i>	
Hyperfunctional	280	25.4	156	124	38.9
Primary hypofunctional	51	4.6	28	23	31.8
Juvenile nodules	50	4.4	28	22	9.8
Adult nodules	165	15.1	28	137	29.5
Polyps	218	19.8	110	108	41.8
Polypoid thickening	115	10.5	29	86	49.6
Contact ulcers	54	4.9	50	4	47.8
Mutational	62	5.9	58	4	23.7
Hemorrhages (cords)	21	1.9	9	12	32.2
Aphonias	38	3.4	6	32	33.2
Spastic dysphonias	45	4.1	20	25	47.8
Total:	1099	100.0	522	577	35.7

TABLE II—ORGANIC VOICE DISORDERS

<i>Diagnosis</i>	<i>No. cases</i>	<i>%</i>	<i>Sex</i>		<i>Mean age</i>
			<i>M.</i>	<i>F.</i>	
Paralysis	54	17.7	24	30	38.4
Nasality	24	7.9	14	10	14.7
Ventricular	10	3.3	7	3	57.9
Leukoplakias	21	6.9	20	1	53.7
Papillomas in children	3	0.9	1	2	8.4
in adults	12	3.9	8	4	51.6
Granulomas	11	3.6	6	5	48.3
Sulcus vocalis	4	1.3	4	—	32.4
Asymmetry	8	2.6	7	1	44.8
Webs	8	2.6	6	2	44.3
Trauma laryngeal	15	4.9	11	4	29.3
Laryngocele	2	0.6	2	—	34.0
Thyroiditis	2	0.6	—	2	26.0
Hormonal	13	4.3	—	13	37.8
Glossectomy	6	2.0	6	—	60.3
Hemilaryngectomy	60	19.7	58	2	59.8
Laryngectomy	52	17.2	44	8	61.8
Total:	305	100.0	218	87	41.8

from studying the faulty habits of voice production we must pay attention to the influence of hormonal dynamics on the voice. For instance, hypofunction of the thyroid gland, even to a slight degree, may produce considerable changes of the voice, lowering of basic pitch, loss of high notes, changes in the quality of the voice. Hormone therapy often produces dramatic improvement of the voice in these cases.

In this connection it may be of general interest to draw attention to recent publications by a number of European authors, particularly Damsté⁵ and Bauer,⁶ who found that anabolic drugs, which are widely used by internists and gynecologists, may produce a virilization of the female voice that is not reversible after withdrawal of the drugs.

Table II is an analysis of the organic disorders of the voice. While the sexes were found to be more or less evenly distributed in tabulating other conditions, the expected exception was in the cancer cases. Of a total of 118 cases of oral and laryngeal cancer, 108 were men and only 10 women. Imbalances of nasality, laryngeal trauma, and papillomas are found mostly in younger persons. At the other end of the scale stand the cancer cases with a mean age of 60.3 years.

METHODS OF REHABILITATION

If we start again with the functional group, we must begin with one important fact: more than in any other branch of rehabilitation psychological considerations are of greatest significance. Psychological dynamics are mirrored in the dynamics of the voice. Emotional conflicts, the stresses of emotional tension in our competitive society, the frustrations caused by the lack of personal or professional achievement—these and many other psychological conflicts focus on the voice as one of the most important expressions of an individual's personality and may create a wrong pattern of vocal function. The voice therapist must be more than a vocal gymnastic teacher. He must know enough of psychology and even psychiatry to understand and handle the psychodynamics of the vocally disturbed patient.

In addition, the voice therapist must acquire much "odd knowledge" that one does not learn in medical school or can find in a textbook. He must know something about the various forms of the professional use of the human voice in the various occupations of modern society. He should know enough about music and artistic singing to be able

to diagnose faults in voice placement and in singing technique. He must understand something of the vocal techniques of the actor of stage and film. And he must be familiar with the problems of public speaking as experienced by the lecturer, the lawyer, the minister, and the teacher. Each profession has its own language, and we can reach the voice patient only if we can talk to him in terms or images that are used by him in his work.

In the functional voice group the first question to decide is whether surgery is necessary. In simple hyperfunctional voice disorders where there are no tissue changes of the vocal cords or in functional aphonia, it is clear that no surgery is required and that vocal rehabilitation is all that is necessary. On the other hand, polyps of the vocal cords must always be removed. When nodules of the vocal cords exist the decision between surgery or conservative treatment is often not easy. If the nodules are large and solidified, surgery must be done first; small and soft nodules often disappear when vocal training eliminates the excessive pressure and tension of the cords that have produced the lesion. But even where laryngeal surgery is necessary, the patient must understand that without vocal rehabilitation recurrences of the nodules will occur. In other words, vocal rehabilitation in such a case is essential to reestablish a physiologically normal approach to the production of voice and to eliminate the danger of recurrences.

To establish this goal a variety of approaches can be used in varying combinations. The use of *drugs* is rarely called for. Corticosteroids are used occasionally to speed up absorption of reactive swelling of the cords after vocal-cord surgery. Tranquilizers may be necessary to control excessive anxiety stages that develop sometimes after the removal of nodules or polyps and interfere with free resumption of the voice after a period of postoperative voice rest. In this connection I should like to mention the fact that voice rest as such has no therapeutic value whatsoever. Voice rest is necessary to allow surgical lesions on the cords to heal but it should be as brief as possible to avoid weakening of the laryngeal muscles through inactivity. In this respect we follow the principles of general rehabilitation by resuming muscular activity as soon as possible.

Physiotherapy may be used in some forms. For instance, if one sends a weak faradic current through the larynx of a person who sings a note the pitch goes up slightly. In weakened voices such a current is

helpful in reestablishing firmer intonation. In patients with vocal-cord paralysis or after hemilaryngectomies this type of faradization facilitates the resumption of phonation. Another method is the so-called harmonic vibration, a form of vibration massage that is synchronized with the vibratory rhythm of the vocal cords.

But the heart of vocal rehabilitation is the use of the various forms of *voice training*. Because of the limitation of space no detailed description of the various techniques is possible. The guiding principle is the consideration of the human voice instrument as a coupled unit where one part acts on the other and where hyperfunction of one part spreads to the others.

In planning vocal exercises we face a peculiar situation. Of the three parts of the voice instrument, namely the lungs as source of breath pressure, the cords as source of vibration, and the supraglottic space as source of resonance, only the first and the third may be controlled consciously. Tension and vibration of the vocal cords are completely automatic and not subject to conscious control. In this respect we are in the same situation as the singing teachers who, whether they know it or not, train vocal-cord function only indirectly by working on breath control and on control of the resonating cavities.

Control of the resonators is of paramount importance because it is here that hyperfunctional constriction often sets the pattern for hyperfunction in the other parts. One method that I have used extensively is the so-called chewing method introduced by Froeschels.⁷ It is based on the fact that the human resonator, throat and mouth, is a unique part of the body because it is one structure that serves two completely different functions: chewing and acting as a resonator. Chewing is the original function that we have in common with all higher animals, while resonance and articulation comprise a secondary function that only man has developed. This applies also to the larynx, which functions in animals as a sphincter and has been adapted by man to fulfill the role of a vibrator that produces sound. In other words, we produce voice and speech with structures that were not originally created for this purpose.

As a rule, primitive functions such as chewing are automatically controlled and better adjusted than higher functions such as speech and voice. By using chewing movements while producing sounds we obtain often a spontaneous elimination of vocal hyperfunction and an

optimal adjustment of the muscles in the walls of the resonator. One of the by-products of the use of the chewing movements is the automatic regulation of the basic pitch of the speaking voice. The fact that pitch is the most conspicuous feature of the speaking voice makes the physician and, too often, also the speech therapist, think of voice therapy primarily in terms of alteration of pitch. Manipulation of pitch is a hazardous undertaking for which no sound objective basis exists, and it is one that depends too much on the subjective preference of the therapist. If general hyperfunction is eliminated from the voice, pitch usually takes care of itself.

The same thing is true of breathing exercises. The often-heard advice: "You have to learn to speak from the diaphragm" does not make sense. One does not speak from the diaphragm. As every doctor knows, the diaphragm contracts actively during inhalation. During exhalation—the phase of speaking and singing—the diaphragm relaxes and is pushed upward passively under the pressure created by contraction of the abdominal muscles. Moreover, contraction or relaxation of the diaphragm cannot be felt.

If breathing exercises are to be used at all in vocal rehabilitation they must be planned with the thought in mind of reducing breath pressure and promoting the utmost economy of release of air. As the great English laryngologist, Dr. Morell Mackenzie, said almost one hundred years ago: "In good speaking and singing the Minimum is always the Optimum."

In hypofunctional voices and, particularly, in vocal-cord paralysis the so-called pushing exercises⁸ are very useful. They make use of the conditioned reflex that coordinates vocal-cord closure and movements in the shoulder girdle. When we need strength in our arms, as in lifting heavy objects or pushing against resistance, we close the vocal cords automatically and thereby immobilize the chest. Therefore the muscles of the shoulder girdle, which insert on the chest wall, have a firmer hold and have more power. By turning this reflex upside down and using energetic downward strokes with the fists with simultaneous phonation we stimulate approximation of the vocal cords to re-establish phonation. This is essential in vocal-cord paralysis, where the healthy cord must cross the midline to reach the paralyzed cord. If this takes place phonation is again possible. By subsequent vocal training the voice can be improved to the degree that a clear voice can be produced,

in some cases to the point where even singing is possible.

If, in spite of systematic voice training, no satisfactory result can be obtained injection of a paste of Teflon into the paralyzed cord (Arnold⁹) may be tried. The bulging of the injected paralyzed cord facilitates contact with the healthy cord on phonation. But this method should be used only as a last resort and not until at least six months after onset of the paralysis. As a rule, most patients with vocal-cord paralysis recover a very satisfactory voice by systematic voice training, with relatively little help.

In disorders of nasality successful rehabilitation of voice and speech depends often on the teamwork of a number of specialists. In those cases where the soft palate has motility good results can be obtained by therapy consisting of planned exercise alone. Where this is not possible, surgical repair by a pharyngeal-flap or so-called push-back operation of the soft palate must be resorted to, followed by systematic training of voice and speech. In cases of palatal defects a dental prosthesis must be used. As a rule, all these cases, particularly cases of cleft palate, are now handled by teams of dental surgeons, orthodontists, and speech therapists. In addition, psychiatric help is often necessary because of the psychiatric overlay that many of these patients present.

In vocal rehabilitation of patients after operations for cancer of the vocal organs we face, of course, a completely different situation. Here we cannot hope to normalize vocal function as we do in the functional cases. We deal with severely handicapped persons, and the best we can do for such a patient is to reestablish some kind of a voice that enables him to function again in social contacts and in his work. For instance, after partial removal of the tongue we must try to develop maximum motility of the stump for articulation. Where this is not possible we make use of the lower lip as a substitute articulator for the tip-tongue sounds. Even after total extirpation of the tongue intelligible speech can be developed.

After removal of one vocal cord or after hemilaryngectomy we face a situation somewhat similar to that of paralysis of the vocal cord except that the healthy cord must now learn to contact the opposing scar instead of a paralyzed cord. In the last few years new methods of reconstructive surgery have been developed to combine radical removal of the cancer with consideration of vocal function. For instance, Conley¹⁰ has introduced a type of hemilaryngectomy with resurfacing

of the interior of the larynx and reconstruction of an artificial vocal cord by a skin flap.

After total laryngectomy the production of voice by air expelled from the lungs is no longer possible, and we must teach the patient the so-called esophageal voice. In this technique air is swallowed into the upper esophagus, and then erupted again and made to vibrate by the contraction of a pseudoglottis at about the level of the hypopharynx.

SUMMARY

The indications for vocal rehabilitation, the principles underlying its application, and the methods used have been briefly discussed. Rehabilitation of the human voice is a relatively new branch of general rehabilitation. It deals with a handicap that can be quite severe, far in excess of physical changes of structure and function. It supplements laryngeal surgery, it helps to prevent recurrences in functional disorders of the voice, and it is indispensable in restoring patients with organic lesions of the vocal organs to useful and satisfying lives.

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